Zeolitic Materials for Nanoscale Electronics & Quantum Computation

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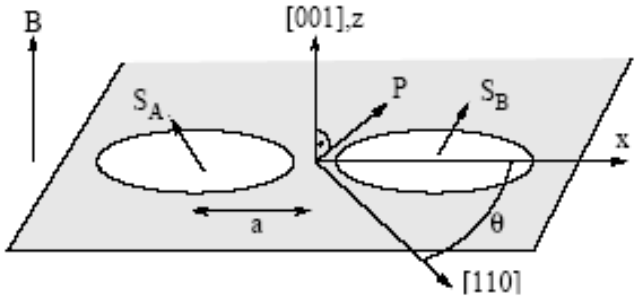
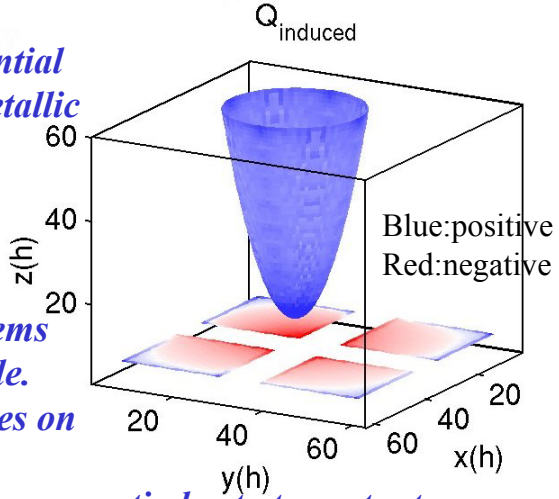
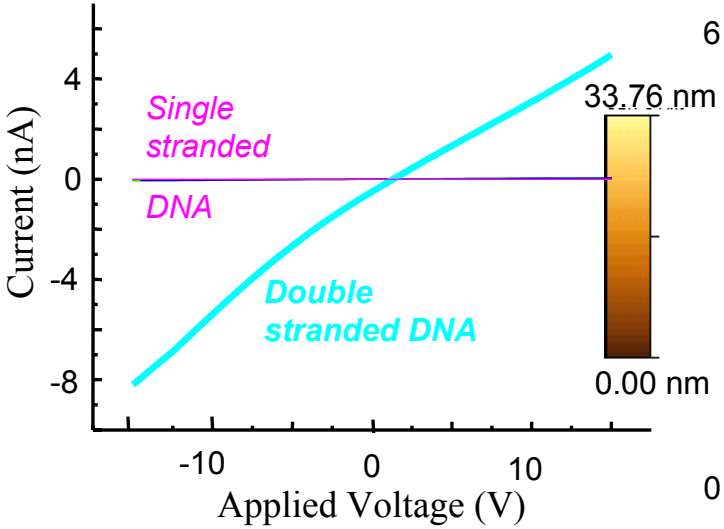


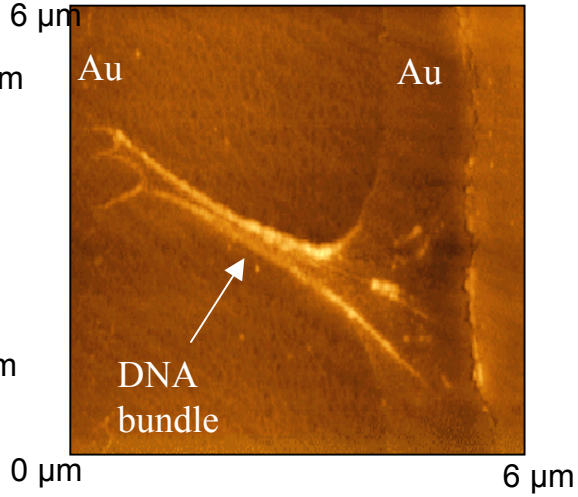
Two GaAs dots lying in the [001] plane making an angle q with the [110] direction. The spin rotates about the vector P when tunneling between dots. We have shown that control over this small rotation can be used for universal quantum computation.

Details of potential values near metallic surfaces aid in understanding the dynamical behavior of electronic systems at the nanoscale. Induced charges on a Scanning Tunneling Microscope tip kept at constant voltage near four metallic neutral islands.

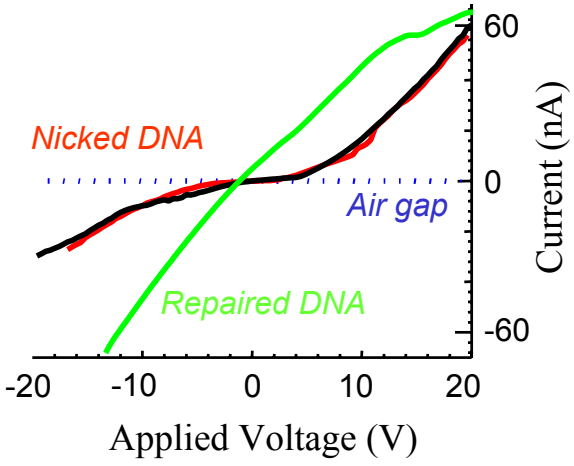




Charge transport through DNA: comparison between single stranded DNA and the double helix



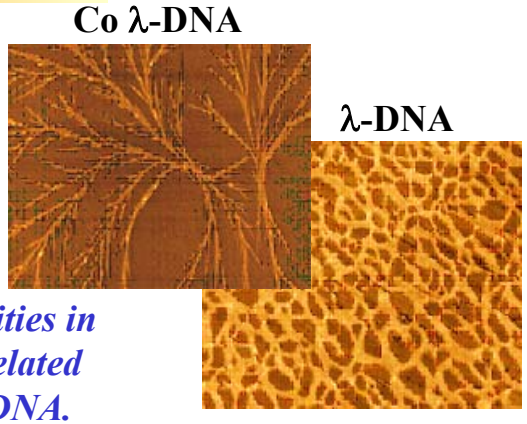
Atomic Force Microscope image of λ-DNA on mica



Charge transport through DNA: comparison between nicked and repaired DNA

Broad scientific impact

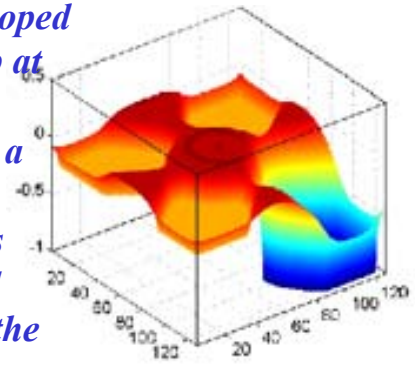
- *Metal contaminants hamper accurate forensic DNA identifications. Here, we show Atomic Force Microscope images of metallated λ-DNA versus λ-DNA. The dissimilarities in surface assembly may be correlated to the behavior of metallated DNA.*



- *Our work on the "effective Hamiltonian" theory to describe pulsed quantum gates may be viewed as part of the nascent field of "quantum control theory", with potential in pulsed field magnetic resonance.*

- *Charge transport through DNA is implicated in DNA damage and repair.*

- *The computational tool developed is currently utilized by a group at ETH-Zurich, Switzerland, to characterize a ring defined on a semiconductor-based two-dimensional electron gas. This group is developing a new tool of scanning potentiometry at the nanoscale.*

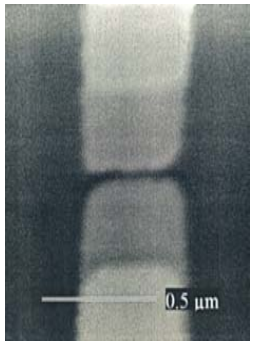


Educational Activities

3 Ohio University undergraduate Physics and Engineering Physics students participated in the research.

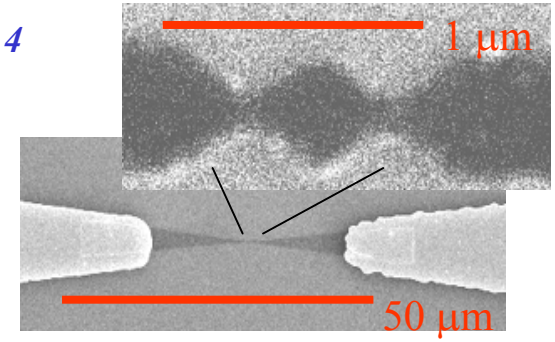
Broader impact

Addressing the public's concern about nanoscale science by creating a course for non-science majors and collaborating with ethicists.



20 nm gap electrodes fabricated by undergraduate Kelsey Edwards

2 post-doctoral fellows, 4 graduate and 3 undergraduate students participated in this interdisciplinary nanoscale research.



Aluminum Single Electron Transistor fabricated by graduates.